



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/689,621	10/22/2003	Tadashi Kai	244233US2SRD	4811
22850	7590	09/20/2005	EXAMINER	
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			HUR, JUNG H	
			ART UNIT	PAPER NUMBER
			2824	

DATE MAILED: 09/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/689,621

Applicant(s)

KAI ET AL.

Examiner

Jung (John) Hur

Art Unit

2824

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 24 June 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 5,10 and 20-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 5,10 and 20-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 6/8/05.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Amendment***

1. Acknowledgment is made of applicant's Amendment, filed 24 June 2005. The changes and remarks disclosed therein have been considered.

Claims 1-4, 6-9 and 11-19 have been cancelled, and claims 20-29 have been added by the Amendment. Therefore, claims 5, 10 and 20-29 are pending in the application.

### ***Information Disclosure Statement***

2. Acknowledgment is made of applicant's Information Disclosure Statement (IDS) Form PTO-1449, filed 08 June 2005. The information disclosed therein was considered.

### ***Specification***

3. Claims 5 and 20-27 are objected to because of the following informalities:

In claim 5 (as amended), lines 15 and 16, starting with "wherein the first nonmagnetic film," appear to be a typographical error and not intended to be present. It will be understood as such and will not be considered.

Claims 20-27 recite "the first nonmagnetic layer" which appears to be in error. In view of the disclosure as a whole, including the corresponding independent claims, each of said claims will be understood to be reciting a specific layer from the group in the corresponding independent claims; therefore, said phrase in each claim will be understood as --the nonmagnetic film--.

Appropriate correction is required.

*Claim Rejections - 35 USC § 103*

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 5, 10, 20-24, 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kishi et al. (JP 2002-280642 A, and its JPO computer translation) in view of Hayashi et al. (U.S. Pat. Appl. Pub. No. 2002/0097540).

Kishi, for example in Figs. 1, 6, 10 and 11, discloses a magnetic memory (Fig. 11) comprising: a word line (41); a bit line (49) intersecting the word line; and a memory cell (47) positioned in an intersection portion of the word and bit lines (see Fig. 11) and including the magnetoresistance element, the magnetoresistance element comprising: a free layer (9 in Figs. 1 and 10) comprising a first ferromagnetic layer (3) and a second ferromagnetic layer (7) that face each other and whose magnetization directions are equal to each other (see for example Figs. 6a and 6b) and a nonmagnetic film (5) intervening between the first and second ferromagnetic layers, the free layer being changeable in the magnetization directions on applying a magnetic field (see for example paragraph [0055]); a first pinned layer comprising a third ferromagnetic layer (13) that faces the free layer, the first pinned layer retaining a magnetization direction thereof on applying the magnetic field (see for example paragraph [0043]); and a first nonmagnetic layer (11) intervening between the free layer and the first pinned layer;

wherein the nonmagnetic film is a layer having a thickness of 0.8 nm to 1.2 nm, 1.4 nm to 1.8 nm, 1.0 nm, or 0.5 nm to 1.5 nm (which are included in the range of 0.1 nm to 10 nm, in paragraph [0077]; see also Table 1);

and a second pinned layer comprising a fourth ferromagnetic layer (19 in Fig. 10) that faces the first pinned layer with the free layer interposed therebetween, the second pinned layer retaining a magnetization direction thereof on applying the magnetic field (see for example paragraph [0103]); and a second nonmagnetic layer (21) intervening between the free layer and the second pinned layer.

However, Kishi does not disclose that the nonmagnetic film is a layer made of a material selected from the group consisting of molybdenum, rhenium, tungsten and niobium, or the group consisting of silicon, germanium,  $\text{Al}_2\text{O}_3$  and  $\text{AlN}$  (instead, Kishi discloses Ru, Au, Ag and Cu as the exemplary nonmagnetic film; see for example paragraphs [0050] and [0077]).

Hayashi, for example in Fig. 64 and paragraph [0229], discloses a nonmagnetic film (13, between two magnetic layers 12 and 8b) made of a material selected from the group of niobium (Nb), molybdenum (Mo), tungsten (W), rhenium (Re), and silicon (Si); said group also includes Ru, Au, Ag and Cu, which are disclosed as the exemplary nonmagnetic film material in Kishi.

Hayashi shows that Nb, Mo, W, Re and Si (recited in the instant claims) and Ru, Au, Ag and Cu (disclosed in Kishi) are equivalent materials known in the art, for their use as a nonmagnetic film material between magnetic layers. Since these materials were art-recognized equivalents at the time the invention was made, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to select any material from the group consisting of Nb, Mo, W, Re and Si, and substitute it for the nonmagnetic film of Kishi.

6. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kishi et al. in view of Hayashi et al. as applied to claim 10 above, and further in view of Takada et al. (U.S. Pat. No. 5,828,527).

The Kishi/Hayashi combination discloses a magnetic memory as in claim 10 above, with the exception of the nonmagnetic film being the third layer (i.e., made of  $\text{Al}_2\text{O}_3$  and having a thickness of 1.0 nm) or the fourth layer (i.e., made of  $\text{AlN}$  and having a thickness of 0.5 nm to 1.5 nm).

Takada, for example in Fig. 5, discloses a nonmagnetic film made of  $\text{Al}_2\text{O}_3$  (layer 11c, as a coupling layer between two magnetic layers 11b and 11d; see column 6, lines 49-56 and column 7, lines 52-60; “such as” implies that other materials may be considered) having a thickness of 1.0 nm (included in the range of 0.3 nm to 3.0 nm; see column 9, lines 37-49).

Since Hayashi discloses, for example in Fig. 10 and paragraph [0119], the equivalence of  $\text{Al}_2\text{O}_3$  and  $\text{AlN}$  as a nonmagnetic material, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to select  $\text{Al}_2\text{O}_3$  with a thickness of 1 nm (as in Takada) or equivalently  $\text{AlN}$  with a thickness of 0.5 nm to 1.5 nm (in view of Hayashi and Takada), and substitute it for the nonmagnetic film of Kishi.

7. Claims 5, 10, 20-22, 24, 25, 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kishi et al. (JP 2002-280642 A, and its JPO computer translation) in view of Koi et al. (U.S. Pat. Appl. Pub. No. 2001/0013999).

Kishi, for example in Figs. 1, 6, 10 and 11, discloses a magnetic memory (Fig. 11) comprising: a word line (41); a bit line (49) intersecting the word line; and a memory cell (47) positioned in an intersection portion of the word and bit lines (see Fig. 11) and including the magnetoresistance element, the magnetoresistance element comprising: a free layer (9 in Figs. 1 and 10) comprising a first ferromagnetic layer (3) and a second ferromagnetic layer (7) that face each other and whose magnetization directions are equal to each other (see for example Figs. 6a and 6b) and a nonmagnetic film (5) intervening between the first and second ferromagnetic layers, the free layer being changeable in the magnetization directions on applying a magnetic field (see for example paragraph [0055]); a first pinned layer comprising a third ferromagnetic layer (13) that faces the free layer, the first pinned layer retaining a magnetization direction thereof on applying the magnetic field (see for example paragraph [0043]); and a first nonmagnetic layer (11) intervening between the free layer and the first pinned layer;

wherein the nonmagnetic film is a layer having a thickness of 0.8 nm to 1.2 nm, 1.4 nm to 1.8 nm, 1.0 nm, or 0.5 nm to 1.5 nm (which are included in the range of 0.1 nm to 10 nm, in paragraph [0077]; see also Table 1);

and a second pinned layer comprising a fourth ferromagnetic layer (19 in Fig. 10) that faces the first pinned layer with the free layer interposed therebetween, the second pinned layer retaining a magnetization direction thereof on applying the magnetic field (see for example paragraph [0103]); and a second nonmagnetic layer (21) intervening between the free layer and the second pinned layer.

However, Kishi does not disclose that the nonmagnetic film is a layer made of a material selected from the group consisting of molybdenum, rhenium, tungsten and niobium, or the group

Art Unit: 2824

consisting of silicon, germanium, Al<sub>2</sub>O<sub>3</sub> and AlN (instead, Kishi discloses Ru, Au, Ag and Cu as the exemplary nonmagnetic film; see for example paragraphs [0050] and [0077]).

Koi, for example in Figs. 2-4 and paragraphs [0056] and [0057], discloses a nonmagnetic film (6, between two magnetic layers 5 and 7A) made of a material selected from the group of molybdenum (Mo), tungsten (W), rhenium (Re), silicon (Si) and germanium (Ge); said group also includes Ru, Au, Ag and Cu, which are disclosed as the exemplary nonmagnetic film material in Kishi.

Koi shows that Mo, W, Re, Si and Ge (recited in the instant claims) and Ru, Au, Ag and Cu (disclosed in Kishi) are equivalent materials known in the art, for their use as a nonmagnetic film material between magnetic layers. Since these materials were art-recognized equivalents at the time the invention was made, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to select any material from the group consisting of Mo, W, Re, Si and Ge, and substitute it for the nonmagnetic film of Kishi.

### *Response to Arguments*

8. Applicant's arguments filed 24 June 2005 have been fully considered but they are not persuasive.

Regarding claims 5 and 10, Applicant argues, in the first full paragraph on page 12, that Kishi "do not disclose materials or the thickness of the nonmagnetic films recited in amended Claims 5 and 10."

Further, Applicant argues, in the subsequent paragraph, that Hayashi "on the other hand does not disclose a magnetic memory....Hayashi et al. relates to a magnetoresistance effect



Art Unit: 2824

element for writing and reading an information signal on magnetic storage media.

Thus,...Hayashi et al disclosure has no relation to a magnetic memory.”

In addition, Applicant argues, in the same paragraph, that “[a]ccordingly, neither nonmagnetic layer 4 in Fig. 4 nor nonmagnetic layer 13 in Fig. 64 is a layer included in a free layer.”

In response, it is noted that Kishi discloses, in paragraph [0077], a range of 0.1 nm to 10 nm for the nonmagnetic film thickness, which includes the recited ranges in amended claims 5 and 10, and implies, in paragraphs [0050] and [0077], that materials other than Ru, Cu, Au and Ag may be considered for the nonmagnetic film (based on the use of “such as” and “etc.” in the translation).

Further, it is noted that the basic device structure and the basic principle of operation of Hayashi’s device are very similar to that of Kishi’s, namely, having a free layer and a fixed or pinned layer and the magnetoresistive interaction between the layers. Also, Kishi discloses, in paragraphs [0001], [0042] and [0106], that its disclosure is applicable to a magnetic head. Thus, one of ordinary skill in the art would find Kishi and Hayashi to be analogous and combinable.

In addition, it is noted that Kishi was cited for the nonmagnetic film included in a free layer, while Hayashi was cited as a secondary reference from the analogous art to show equivalent materials for the nonmagnetic film of Kishi, that were known in the art and that would have been substituted for the nonmagnetic film of Kishi by one of ordinary skill in the art. It is also noted that the nonmagnetic film in Hayashi is for coupling two adjacent magnetic layers,

Art Unit: 2824

similar to that of Kishi (see Hayashi paragraph [0229]), with a thickness within the range disclosed in Kishi (see Hayashi paragraphs [0360]-[0366]).

### *Conclusion*

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Hiramoto et al. (U.S. Pat. Appl. Pub. No. 2002/0055016)

Inage et al. (U.S. Pat. Appl. Pub. No. 2002/0036497)

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Art Unit: 2824

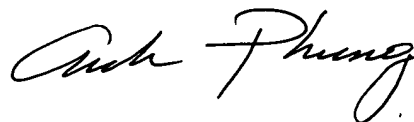
11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jung (John) Hur whose telephone number is (571) 272-1870.

The examiner can normally be reached on M-F 6:30 AM - 3:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on (571) 272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

jhh



**ANH PHUNG**  
**PRIMARY EXAMINER**